State of California **Business, Transportation and Housing Agency**

Memorandum

To: Rosa Munoz
Public Utilities Commission

Date: October 30, 2000

From: **DEPARTMENT OF TRANSPORTATION**
Engineering Service Center

Subject: Grade Separation Priority List Formula Workshop

Attached are Caltrans' comments regarding the Grade Separation Priority List Formula, to be considered for discussion at the upcoming workshop scheduled for Wednesday, December 6, 2000. This will also serve to confirm Caltrans' attendance at the workshop. We look forward to working with Commission Staff and other participants at the workshop.

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Attachment

CALTRANS COMMENTS AND RECOMMENDATIONS
REGARDING THE PUC GRADE SEPARATION FORMULA

Discussion of Existing Formula

The following discussion applies only to the formula for crossings nominated for separation or elimination, since these projects comprise the vast majority of the list. Any modifications to this formula should be accompanied by a corresponding modification to the formula for existing crossings nominated for alteration or reconstruction, in order to maintain consistency.

1. The VT/CF Factor

The biggest single problem with the current formula is that the factors that should (and were originally intended to) provide the underlying basis for the ranking of projects, namely vehicular traffic (V), train traffic (T), and cost (C x F), have been rendered insignificant by the various "special conditions factors" that have been inserted into the formula over the years. This is illustrated in the accompanying Table, which shows 1) the priority index number for all projects on the current list, and 2) the percentage of that number which is attributable to the basic VT/CF factor. On average, the VT/CF factor accounts for a mere 11.7 percent of the overall priority index assigned to projects. In many cases, it is below five percent, and in only one case does it exceed 30 percent. This is a classic "tail wagging the dog" situation, in which factors that were originally intended to make allowances for projects that had unusual conditions are now dominating the entire ranking process.

2. The AH Factor

One of the most striking examples of this is the application of the Accident History (AH) factor. This is discussed at length in the comments submitted by Robert M. Barton on October 22, 1999. Caltrans agrees with Mr. Barton's analysis on this issue, but would go one step further in recommending that the AH factor be eliminated entirely. The reason for this recommendation is that accidents occur so infrequently that they do not render a fair comparison when applied in a formula of this nature. Furthermore, the "accident potential" for crossings is already factored into the formula in a number of ways. The most significant of these, of course, is through the use of the V x T calculation, which is a measure of the number of *potential* conflicts. In addition, a number of the Special Conditions Factors, including the vehicular speed limit (VS), railroad speed (RS), and crossing geometrics (CG), take into account conditions that can contribute to accident potential.

3. The BD Factor

Another issue discussed in Mr. Barton's comments is the unusual effects of the Blocking Delay (BD) factor. In his analysis, he presents an example in which the

addition of a number of very short trains through a crossing has little or no effect on the priority index, due to the application of the Blocking Delay factor. The reason this occurs is simple: The BD factor is computed by taking the total number minutes of delay per day, divided by the total number of trains per day. When this is multiplied by the (V x T) factor, the number of trains per day (T) is *mathematically cancelled in the formula*. Accordingly, when the BD factor is applied in the current formula, one of the primary elements, the number of daily trains, is eliminated entirely as a factor. While Caltrans agrees that the BD factor is worth retaining, it obviously needs to be applied to the formula in a different manner.

4. The SCF Factor

The accompanying table also illustrates the impact of the SCF factor on the priority index numbers of the projects on the current PUC list. (The SCF factor is separate from both the Accident History and Blocking Delay factors.) The average impact of the SCF factor on the priority index number is 54.6 percent, and, in several cases, exceeds 75 percent. This is yet another example of the "skewed" nature of the current formula.

A Recommended Modification to the Formula

It is Caltrans' opinion that the basic VT/CF calculation should always be the greatest single factor in the formula. Accordingly, it is suggested that the formula be modified in such a manner that the VT/CF value is never less than two-thirds of the total priority index number. In other words, the application of the SCF's should be such that the priority index for a proposed crossing in never more than 150% of its VT/CF value. In order to accomplish this, Caltrans proposes the following:

1. Eliminate the Accident History (AH) Factor, as noted above.

2. Compute the Blocking Delay (BD) Factor as it is in the current formula, but increase the maximum possible value to 13 points and incorporate it as an additional element of the SCF factor. This, when added to the other elements that comprise the SCF, would result in an SCF value ranging from 0 to 75 points.

3. Convert the SCF factor to a number that would then be applied as a *multiplier* to the basic VT/CF number. As discussed above, this multiplier should be such that the priority index number is not greater than 150% of the VT/CF value. Mathematically, this can be accomplished by converting the SCF range of 0 to 75 points to a number ranging from 1.0 to 1.5. Zero SCF points would convert to a value of 1.0, 15 SCF points would convert to a value of 1.1, etc. The calculation would be performed as follows:

$$\text{SCF factor} = 1 + [\ (\text{number of SCF points}) \div 150\ ]$$

With these modifications, the formula would look like this:

$$P = \frac{V \times (T + 0.1 \times LRT) \times SCF}{C \times F}$$

Where:

P = Priority Index Number
V = Average 24-hour Vehicular Volume (1 point per vehicle)
C = Total Separation Project Costs (1 point per thousand dollars)
T = Average 24-hour Train Volume (1 point per train)
LRT = Average 24-hour Light Rail Train Volume (1 point per train)
F = Cost Inflation Factor
SCF = Special Conditions Factor = 1 + (BD+VS+RS+CG+AR+PT+OF) ÷ 150

BD = Crossing Blocking Delay (up to 13 points)
VS = Vehicular Speed Limit (up to 5 points)
RS = Railroad Prevailing Maximum Speed (up to 7 points)
CG = Crossing Geometrics (up to 17 points)
AR = Alternate Route Availability (up to 5 points)
PT = Passenger Trains (up to 10 points)
OF = Other Factors (up to 18 points)

This formula methodology also has the advantage of allowing alterations to be made to the elements that comprise the Special Conditions Factors without inadvertently creating an unusual bias in the formula itself. As an example, if it were determined that the VS value should have more weight and therefore be increased to a maximum value of 10 points, the total possible number of SCF points would be increased from 75 to 80. By correspondingly increasing the divisor in SCF formula from 150 to 160, the basic premise of the formula – in which the priority index is no greater than 150% of the VT/CF value – would be maintained.

PUC GRADE SEPARATION PRIORITY LIST -- FY 2000-2001

COMPARISON OF PROJECTS

Rank	Project	V	T	C	SCF	**Priority Index**	VT/CF (F=8.32)	**VT/CF % of Index**	**SCF % of Index**
1	Nogales	43290	51	14514	31.32	**157.47**	18.28	**11.6%**	**19.9%**
2	Sierra	12867	60	9216	28.68	**153.23**	10.07	**6.6%**	**18.7%**
3	Beale-Truxton-Baker	19870	39	17680	62.13	**152.95**	5.27	**3.4%**	**40.6%**
4	Monte Vista	12514	77	8500	31.00	**133.46**	13.63	**10.2%**	**23.2%**
5	Fremont Consol.	84598	11	28230	90.30	**125.25**	3.96	**3.2%**	**72.1%**
6	Valley	29203	68	30700	29.39	**123.38**	7.77	**6.3%**	**23.8%**
7	Fairway	33205	51	13056	29.48	**107.43**	15.59	**14.5%**	**27.4%**
8	Jurupa	16190	55	13300	44.92	**100.85**	8.05	**8.0%**	**44.5%**
9	Sand Canyon	22000	62	15810	43.00	**93.71**	10.37	**11.1%**	**45.9%**
10	San Joaquin Consol.	10511	38	10444	46.32	**86.91**	4.60	**5.3%**	**53.3%**
11	BNSF Consol.	6777	38	6439	36.72	**72.48**	4.81	**6.6%**	**50.7%**
12	Palmdale	33260	60	15030	32.84	**71.94**	15.96	**22.2%**	**45.7%**
13	Norwalk	23247	110	23495	38.80	**69.54**	13.08	**18.8%**	**55.8%**
14	Q St.	9252	36	7145	24.20	**68.29**	5.60	**8.2%**	**35.4%**
15	Dillon	14269	36	6375	26.44	**68.08**	9.68	**14.2%**	**38.8%**
16	Lathrop (ex-WP)	10497	26	6720	25.00	**64.34**	4.88	**7.6%**	**38.9%**
17	Turnbull Canyon	22136	51	16974	30.36	**63.45**	7.99	**12.6%**	**47.8%**
18	San Jose Consol.	6298	20	6950	41.24	**63.02**	2.18	**3.5%**	**65.4%**
19	Cecil	18000	18	7848	25.06	**61.93**	4.96	**8.0%**	**40.5%**
20	West	22873	13	9100	26.80	**58.73**	3.93	**6.7%**	**45.6%**
21	Fremont Consol. (Alt.)	49976	11	39935	43.00	**57.59**	1.65	**2.9%**	**74.7%**
22	Bandini	28453	39	29338	38.40	**56.18**	4.55	**8.1%**	**68.4%**
23	North Main	14188	117	55040	42.46	**56.09**	3.62	**6.5%**	**75.7%**
24	Adolfo	18019	34	7390	26.00	**55.49**	9.96	**18.0%**	**46.9%**
25	Olive	17200	44	7070	28.50	**55.13**	12.87	**23.3%**	**51.7%**
27	Lathrop (ex-SP)	10497	20	6150	22.00	**54.29**	4.10	**7.6%**	**40.5%**
28	McKinley	33720	51	17250	34.44	**53.61**	11.98	**22.4%**	**64.2%**
30	Los Posas/Upland	18046	34	6522	30.00	**52.16**	11.31	**21.7%**	**57.5%**
31	Brookshire	18766	11	8315	22.00	**51.84**	2.98	**5.8%**	**42.4%**
32	Florin	37022	16	10000	23.00	**50.98**	7.12	**14.0%**	**45.1%**
33	Warren	11725	49	10688	22.00	**49.85**	6.46	**13.0%**	**44.1%**
34	Rosamond	13400	18	6720	28.26	**49.40**	4.31	**8.7%**	**57.2%**
35	South St.	12405	39	7010	21.40	**47.36**	8.30	**17.5%**	**45.2%**
36	7th Standard	5300	62	7454	30.80	**47.17**	5.30	**11.2%**	**65.3%**
37	Del Amo	29000	29	18722	15.60	**42.60**	5.40	**12.7%**	**36.6%**

38	Slauson	35021	20	17992	29.80	**42.43**	4.68	**11.0%**	**70.2%**
39	South Ave.	4970	23	2558	27.00	**40.96**	5.37	**13.1%**	**65.9%**
40	E St.	28643	2	15381	17.70	**40.61**	5.06	**12.5%**	**43.6%**
42	Bowman	5116	27	2484	28.30	**36.99**	6.68	**18.1%**	**76.5%**
43	Garces	9957	18	7095	19.89	**33.34**	3.04	**9.1%**	**59.7%**
44	Avenue S	21032	22	28243	22.80	**31.29**	1.97	**6.3%**	**72.9%**
45	Hargrave	2710	36	6960	19.00	**30.62**	1.68	**5.5%**	**62.0%**
47	Firestone	66310	14	25074	20.20	**27.32**	4.45	**16.3%**	**73.9%**
48	El Segundo	15332	2	24185	25.00	**26.64**	1.95	**7.3%**	**93.8%**
50	Hageman	15126	6	2820	15.98	**21.78**	3.87	**17.8%**	**73.4%**
51	Palomar	41480	3	17381	17.69	**21.41**	6.77	**31.6%**	**82.6%**
52	H St.	23546	2	17381	18.45	**20.40**	3.68	**18.0%**	**90.4%**
53	Flores	10850	13	9630	11.12	**13.87**	1.76	**12.7%**	**80.2%**
54	Imola	28200	1	2000	10.40	**13.23**	1.69	**12.8%**	**78.6%**
	Average							**11.7%**	**54.6%**
	Lowest							**2.9%**	**18.7%**
	Highest							**31.6%**	**93.8%**

Note: This table does <u>not</u> include the five projects that were nominated for alteration or reconstruction. A different formula applies to such projects.

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29	North Spring	19676	117	10146	26.20	**53.47**	27.27	**51.0%**	**49.0%**
26	West Capital (Emerg.)	7848	6	350	38.20	**54.37**	16.17	**29.7%**	**70.3%**
46	Sycamore	8218	35	7800	23.00	**27.43**	4.43	**16.2%**	**83.8%**
49	Palm	5000	35	6740	21.00	**24.12**	3.12	**12.9%**	**87.1%**
41	West Capital (Perm.)	7848	6	5320	38.20	**39.26**	1.06	**2.7%**	**97.3%**